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Implementing Sustainability - Barriers and Chances

Young Researchers Session for undergraduate and graduate students

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Solar Potential and Interactive Design in the Urban Context

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Problem Statement

The performance of a building energy-wise is strongly conditioned by its level of solar exposure, which notably influences heating, cooling, and artificial lighting needs. These can be decreased by exploiting solar radiation through passive measures (e.g. daylighting), while active systems (e.g. photovoltaic) can be used to meet the remaining demand. As such, it is essential to assess the solar potential of buildings at the early design phase, when design parameters (e.g. orientation), which influence the solar exposure level, are being fixed. In doing so, the existing and planned context must be considered, due to inter-building impacts (e.g. shadowing).

Methodology

Concept

Early design phase support method to improve the solar potential of urban districts/neighborhood designs (considering the inter-building influence), by progressively and interactively proposing modifications of key variables (e.g. building height) to be accepted/rejected by the designer based on personal objectives.

Evaluation method

Multi-criteria evaluation of 4 (conflicting) performance criteria: potential for

- (i) daylighting,
- (ii) passive heating,
- (iii) passive cooling,
- (iv) active system installation,

based on solar irradiation of exposed surfaces.

Improvement-search method

Ranking of alternatives in the solution space defined by variable early design parameters.

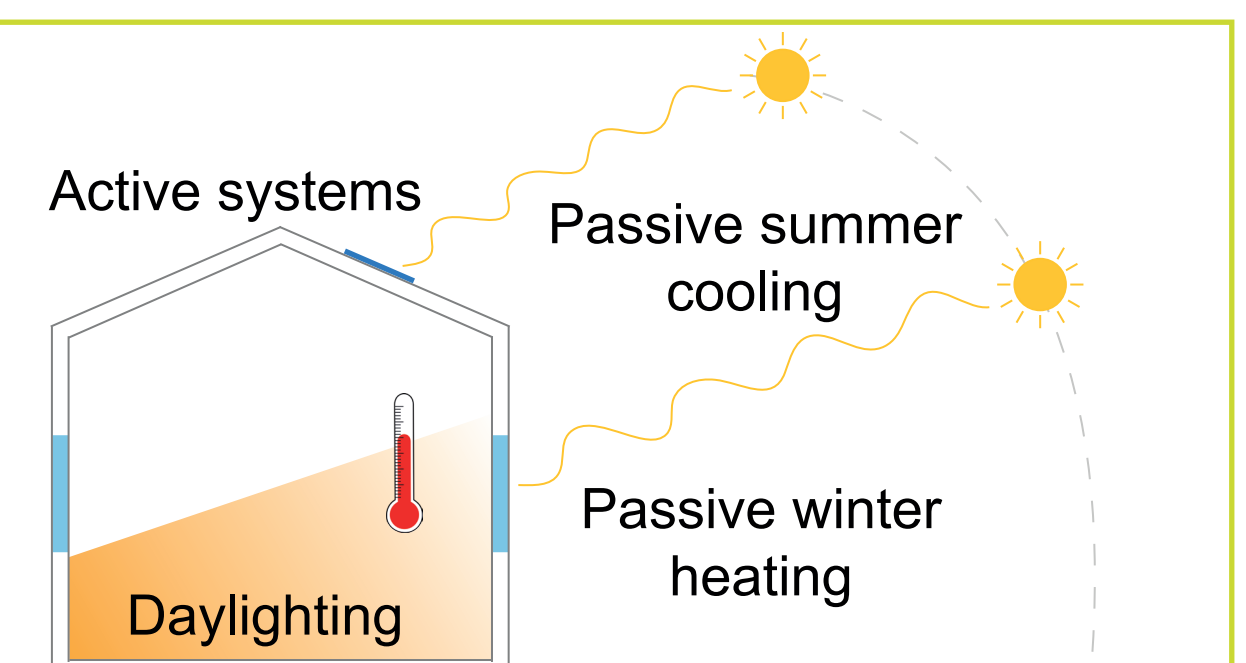
Outcome

Iterative design modification propositions (modified 3D model) and associated performance in graphical form (e.g. temporal map).

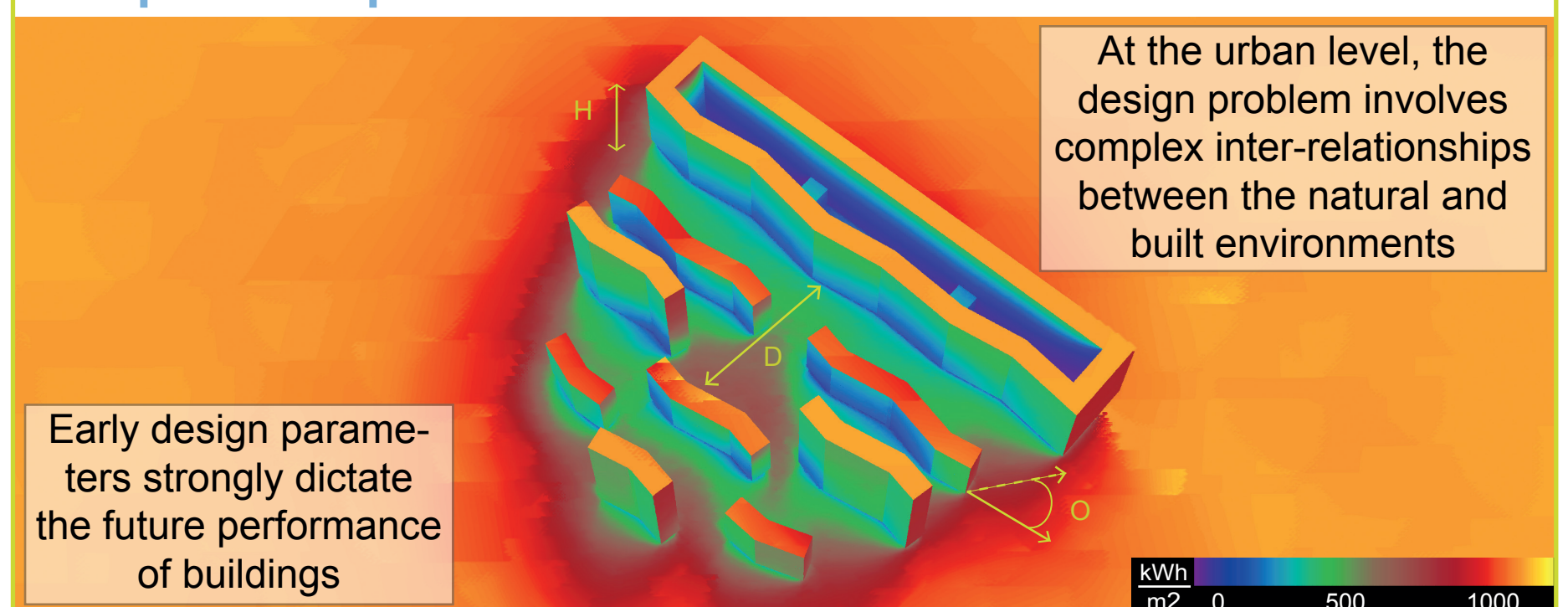
Perspective

The methodology is to be integrated seamlessly into the creative exploration process, simultaneously allowing its acceleration by providing support in a reactive way to the designer, as in a dialogue with a virtual consultant. The approach will be validated through case-studies and established software as well as tested with students and in urban planning and architecture offices.

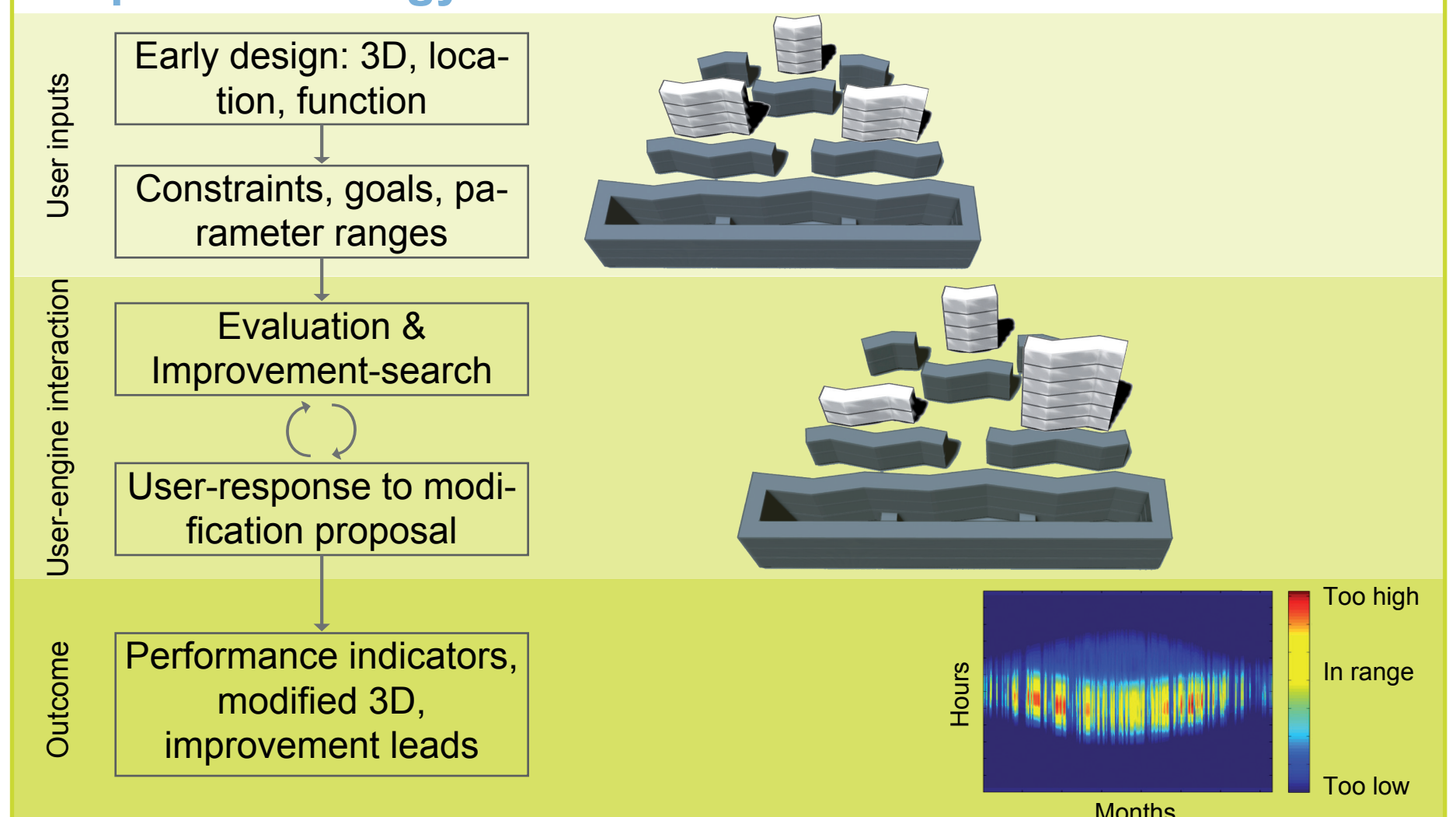
Solar performance criteria



Temporal & spatial focus



Proposed strategy



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